ATTACHMENT #18
FILTER SYSTEMS

18.1 BACKGROUND

The filter system consists of highly efficient units designed to remove particulates contaminated with agent, and chemical agents in aerosol, and gaseous form. The basic design of each of the filter units is an adaption of filter units that are used in the nuclear power industry. The primary component of the filter units that remove the toxic chemical agent is the activated carbon adsorption filter. All of the USACAMDS filter units employ a standard tray-type carbon adsorption filter unit that is also used in the nuclear power industry.

18.2 DESCRIPTION

The USACAMDS filter units are comprised of the following major components:

- Housing
- Pre-Filter
- High Efficiency Particulate Air (HEPA) Filter
- Activated Carbon (Charcoal) Trays
- Fan
- Associated lnstrumentation

The housing is designed to provide structural rigidity and leak tightness.

Within the housing of each filtration unit is a pre-filter that removes most of the large particles from the air passing through the unit. The air then passes through a High Efficiency Particulate Air (HEPA) filter that removes smaller particles. Next, the air passes through one or more banks of activated charcoal filters that adsorb any agent vapors. Then the air passes through a second bank of HEPA filters, into the fan, then through the stack to the atmosphere.

The filters that adsorb the agent vapors consist of granules of activated carbon in metal trays. The metal surfaces of the trays that are perpendicular to the airflow are perforated so the air flows through the perforations and comes in contact with the activated carbon granules. Each tray in the bank is fitted with a gasket and secured to the frame with multiple bolts to provide a leak-proof assembly through the activated carbon filter bank (all of the air must pass through the activated carbon.) Airflow through each filter unit is provided by a centrifugal fan. The largest filter units have 100 horsepower electric fan motors and move up to 16,000 CFM of air. Each filter unit is equipped with differential pressure sensors to measure the pressure drop across each bank of pre-filters and HEPA filters and across the entire filter housing. A change in the pressure differential between the inlet and outlet of a pre-filter or HEPA filter bank is a good indicator of the condition of the filters, so the pressure differential readings are monitored during operation of the filter unit to assure that the banks are not clogged and are functioning properly. Airflow through the filter system is controlled by dampers within the ducts or by motor speed controllers on the filter fan motors.

18.3 MONITORING FILTER BANKS FOR AGENT

The carbon adsorption banks are continuously monitored for agent breakthrough by ACAMS. Filter units that have six banks of carbon are monitored for agent after the first, the second and the fourth banks. Filter units that have two banks of carbon have an agent monitor after the first bank of carbon. All filter units have an agent monitor that monitors the air exiting the filter unit. This exiting-air agent monitor also serves as an agent break through monitor for the last carbon bank. All monitoring locations within a filter bank will monitor for all possible agents that could have contaminated the carbon banks based upon USACAMDS knowledge of agent types being treated at the facility.

Filter units that are potentially subjected to large amounts of agent have six banks of carbon adsorption filters. Filter units that will potentially see only limited amounts of agent (i.e., the CAMDS Lab), have only two banks of carbon adsorption filters.

Agent that breaks through the first bank of carbon adsorption filters will be adsorbed in subsequent banks of carbon because agent break through of subsequent banks of carbon does not occur simultaneously. When agent break through is detected after the second bank of carbon, action will immediately be taken to stop further break through.

18.4 FILTER SHUT-DOWN FOR CHANGE OUT OF A CARBON BANK

Shut-down of a filter for change-out of a carbon bank involves closing the damper at the outlet of the filter unit, leaving the damper at the inlet of the filter unit at least partly open and shutting down the filter fan. This results in a negative pressure relative to atmospheric pressure within the filter unit during change-out.

When change-out of a carbon bank is required, all carbon trays in that bank are changed at the same time. Only the contaminated banks that could have been contaminated in the filter housing are changed out. If agent breakthrough is detected downstream of the first and second banks of carbon but not detected downstream of the fourth bank of carbon, all of the trays in the first, second and third banks of carbon will be replaced at the next scheduled chemical agent changeover. If agent breakthrough is detected downstream of the fourth bank of carbon, the standby filter will be started immediately and all trays of all banks of carbon will be replaced.

18.5 MANAGEMENT OF SPENT CARBON

Spent carbon is put into steel drums and stored as hazardous waste.

18.6 VENTILATION INSPECTION

The following items are inspected daily.

- The ventilation system is visually inspected for evidence of corrosion or malfunctions.
- The filters are checked for pressure drop.
- The airflow is checked.
- The filters are visually inspected for evidence of excessive wear.

- The chemical agent monitors are visually inspected to ensure that required monitors are present and operational.

Internal mechanical systems are checked when filter banks are changed.

18.7 DESCRIPTION OF FILTER SYSTEMS

All filters are type II and use carbon trays.

18.8 TEST METHODS

Initial acceptance of a new filter unit for use in filtering air contaminated with agent during USACAMDS operations and similar acceptance of an existing filter unit that has had activated carbon changed or added is achieved by "challenging" the banks of the filter. A challenge consists of injecting a tracer leak gas upstream of the bank being tested and sensing the concentration of tracer leak test gas both upstream and downstream of the filter bank. Sensitive tracer gas leak detection equipment can establish if tracer gas immediately leaks through the filter bank assembly and the concentrations of the tracer leak gas both up stream and down stream of the carbon absorption filter bank being challenged.